Childhood Lead Poisoning In St. Louis City

2018

City of St. Louis
Department of Health
Center for Health Information,
Planning, & Research

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Executive Summary

Childhood lead poisoning is a persistent problem in the City of St. Louis. Although the childhood lead poisoning rates in St. Louis City have declined dramatically in the past decade, the rates continue to exceed state and national levels. No level of lead is safe for children, and exposures at even low levels can cause intellectual, behavioral and academic deficits. Lead poisoning is a preventable environmental health hazard, and it's the role of the City of St. Louis Department of Health to promote and assure that St. Louis children receive appropriate, adequate, and timely preventative health care and have a safe, healthy home environment.

The three core functions of public health are assessment, policy development, and assurance. These functions relate to population-based activities versus individual health care. For children with lead poisoning, the health department's role includes:

- Collecting and assessing information on the environment and the health of the population to evaluate what has happened, is happening, and future trends.
- Documenting and reporting case findings.
- Linking people to resources, and assuring appropriate medical and case management is provided through follow-up with responsible providers.
- Providing environmental investigations to identify lead hazards that may cause lead exposure.
- Enforcing laws that protect the community.
- Developing policies and plans that assure lead hazards are reduced safely.
- Educating and empowering parents, guardians, and other community members on preventing lead poisoning.
- Promoting routine childhood blood lead testing to diagnosing lead poisoning cases.
- Evaluating the effectiveness and quality of services and workforce, using data to drive improvements and innovative solutions to environmental health problems.

St. Louis City's Community Health Assessment (CHA) was recently completed with input from the community, our partners, and other stakeholders. From this assessment, the Health Department developed a mission statement and priority areas to focus future efforts and resources. The Health Department's mission provides that St. Louis City will be an equitable community achieving optimal health for all. The priority areas include: addressing the social determinants of health as root causes of community health; eliminating the disparities in health and promoting health and racial equity; and improving the local public health system to be able to collectively address the needs of the region. This Lead Poisoning Report will examine lead poisoning data for the past several years to evaluate sources of lead exposure; recognize and predict affected populations and trends; identify what is working and/or what may be lacking within any system that may impact human health; and to report findings. This report will also examine the data through a health equity and racial equity lens. The report will also review the social determinants of health, and how well we are meeting our CHA priorities when it comes to childhood lead poisoning.

We hope this report contributes valuable information to the discussion surrounding childhood lead poisoning in the City of St. Louis.

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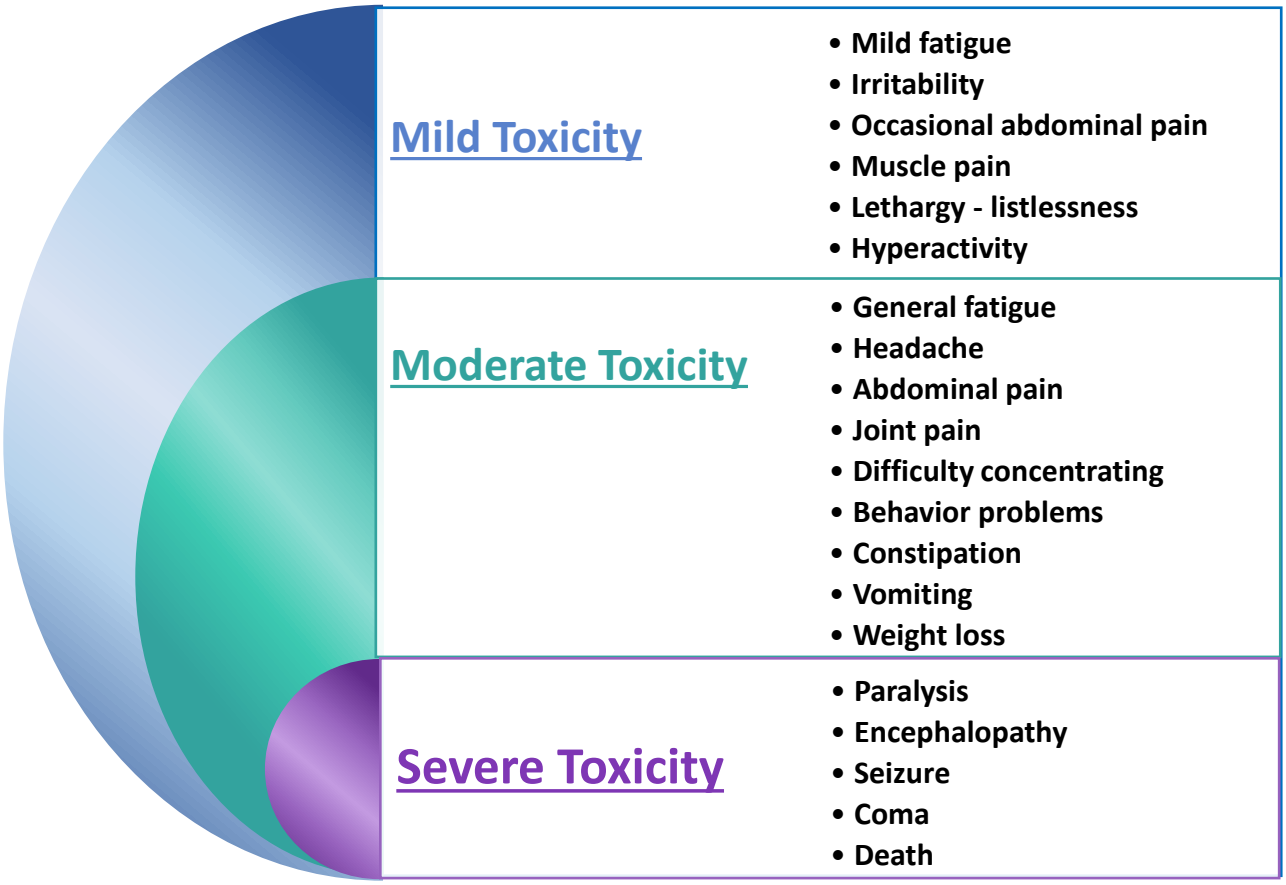
Overview of Lead Poisoning

Lead is naturally occurring heavy metal that has been used in a variety of products such as paints, ceramics, gasoline, dishware, crystal, and lead plumbing. Lead poisoning occurs when lead is ingested or inhaled, or is passed to the unborn children during pregnancy. Children under six years of age are especially at risk because they have a tendency to put things in their mouths which may be covered in lead dust or contaminated with lead-based paints. Historically, the main source of lead was exposure to automobile exhaust from leaded gasoline, but that is no longer the case since the removal of lead from gasoline in the 1970's. Despite the federal government's banning of lead-based paint in 1978, ongoing lead poisoning continues to be a problem in St. Louis City.

Lead poisoning can affect nearly every system in the body, and even at low levels, it can cause neurologic damage and increase the risk of lifetime behavioral and cognitive issues. (Bellinger 2008a, 2008b; Chen et al. 2007; Lanphear et al. 2005). Studies have linked lead poisoning to deficits in IQ's, aggressive behavior, attention deficit hyperactivity disorder, hearing and speech impairments, and to hypertension and coronary heart disease in adulthood. At high lead levels, lead poisoning can cause seizures, coma, and even death. Symptoms of lead poisoning may range from subtle or unnoticeable, to death. Many of the indicators of lead poisoning are common symptoms of numerous other illnesses, and therefore, lead poisoning may not initially be suspected.

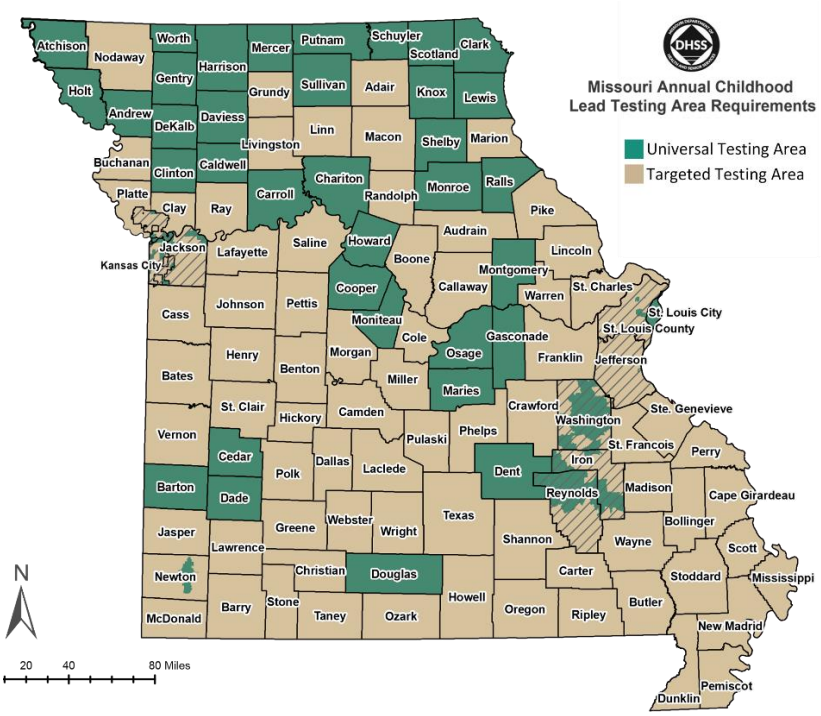


Legislation Requirements:

Testing and Reporting:

Missouri's Testing Statute (RSMo 701.340-701.349) requires the Missouri Department of Health and Senior Services (DHSS) to establish geographic areas in the state considered to be at high risk for lead poisoning and to develop blood testing protocols to be used for lead testing. DHSS is required to define lead testing follow-up and treatment procedures and any other protocols deemed necessary. DHSS has established criteria for determining high-risk areas for lead poisoning in Missouri, it describes who is to perform blood lead testing, testing requirements in high-risk and non-high-risk areas, type of and when to use each type of blood test, follow-up steps for elevated blood lead levels, requirements for child care facility directors in high-risk areas; and reporting requirements for lead poisoning case follow-up activities. Under the DHSS rules, the City of St. Louis is classified as a Universal Testing Area, which requires:

- Any child under the age of 6 years living in or visiting for 10 hours per week or more, the universal testing area, will have their blood tested annually for lead.
- Day care facilities are required to record a "proof of lead testing" signed by the Health Care Provider performing the test within thirty (30) days of the child's enrollment. If the parent/guardian does not provide it or a written statement stating why they do not want the child tested, the Day Care Facility is to offer the parent assistance in scheduling a test.
- Any child found to be at High-Risk, living in a residence that is older than 1978, and is undergoing renovation, may be tested every 6 months and once following completion of the work (this also applies to children found to be at high-risk in targeted testing areas).
- All Medicaid eligible children will be blood tested for lead at age 12 and 24 months of age.



All laboratories are required by MO 19 CSR 20-20.010-080 to report all blood lead test results and required patient information for Missouri citizens to DHSS or the local health authority as follows:

PATIENT'S AGE	BLOOD LEAD TEST RESULTS µg/dl = micrograms per deciliter	TIMEFRAME
72 months or less (<6 years of age)	>45 µg/dl <45 µg/dl	Within 24 hours Within 3 days
73 months or greater (>6 years of age)	All results	Within 3 days

All local health authorities are required by law to forward to DHSS all reported test results within twenty-four (24) hours after being received.

Case Management of Children with Elevated Blood Lead:

Missouri Regulations 19 CSR 20-20.020 defines blood lead as reportable disease, and 19 CSR 20-20.040 requires the local health authority upon receiving a report of a high blood lead level to make necessary investigation, collect any necessary samples to confirm the diagnosis or presence of a physical agent to determine the source of the exposure. This regulation also requires the local health authority to establish appropriate control measures for the protection of public health. The St. Louis City Department of Health works in coordination with medical providers, daycare centers, state agencies, the St. Louis City Building Division, and others to address cases of blood lead poisoning.

Established follow-up protocols by DHSS for children with elevated blood lead levels includes:

- All Children found to have an elevated blood level (EBL) (by confirmatory venous blood lead test) result of 10 μg/dl or greater shall be provided with appropriate follow-up testing and treatment according to the DHSS guidelines/rules.
- Any other children under the age of six years living in same individual housing unit shall also be blood tested for lead.
- Children living in pre-1978 housing that is being renovated may be tested every 6 months and once when the work is completed.

Lead Abatement:

DHSS is required under section 701.300 to 701.338 of the Missouri Revised Statutes to promulgate rules necessary to implement and administer procedures and standards relating to lead-bearing substance activities. The rules established by DHSS shall be at least as protective of human health and the environment as federal laws established by the Residential Lead-Based Paint Hazard Reduction Act (Title X), as amended, 42 U.S.C. 4851 et seq.; the Toxic Substances Control Act (TSCA), as amended, 15 U.S.C. 2605, 2607, and 2681 to 2692; the Pollution Prevention Act 42 U.S.C. §13101 et seq.; and any federal regulations promulgated pursuant to lead prevention and control. Title X requires disclosure of any known information concerning lead-based paint or lead-based paint hazards by homeowners when selling a property, and landlords that own property to rent. TSCA addresses the production, importation, use, and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint. The Pollution Prevention Law mandates several statutes aimed at promoting source reduction of lead, preventing and controlling air and water pollution, and controlling hazardous waste production and disposal. St. Louis City's Building Division operates a Lead Abatement Program that is governed by these established DHSS rules and federal regulations. The Building Division works in partnership with the Health Department in addressing environmental hazards that are identified through blood lead testing and environmental testing.

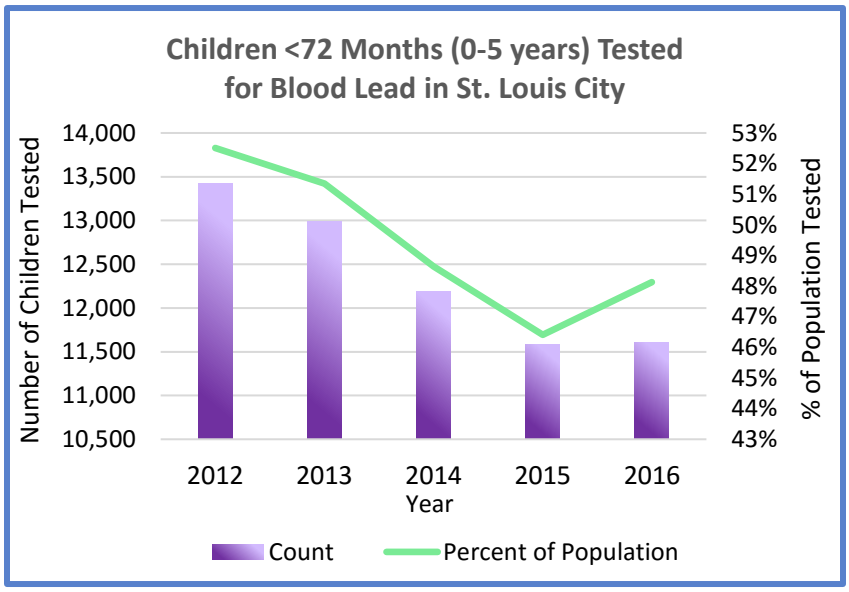
The Lead Contamination Control Act of 1988 mandates the Environmental Protection Agency to develop and enforce standards for lead control, assure laboratory certification for lead testing, and amends the Public Health Service Act to authorize Health and Human Services grants for lead prevention programs.

Surveillance Activities

Childhood Lead Surveillance

The Health Department's Epidemiologist actively collect and monitor data from lead testing and reports received either internally from the Family Community Health Program or from partner organizations, laboratories, and medical providers in the St. Louis Region. All lead testing data received is tracked, followed-up on, analyzed and reported. The Health Department works closely with DHSS to assure their statewide blood lead databased is actively maintained. In addition to collecting lead data, the department collects data on demographics, health statistics, the environment, social and behavioral health, economics, etc. This data is analyzed for frequencies, patterns and trends. Cross-sectional analysis is conducted to identify risk factors associated with lead poisoning. Data analysis is also used for research, evaluating new innovative methods, and developing evidence-based practices that can be shared with other public health professionals.

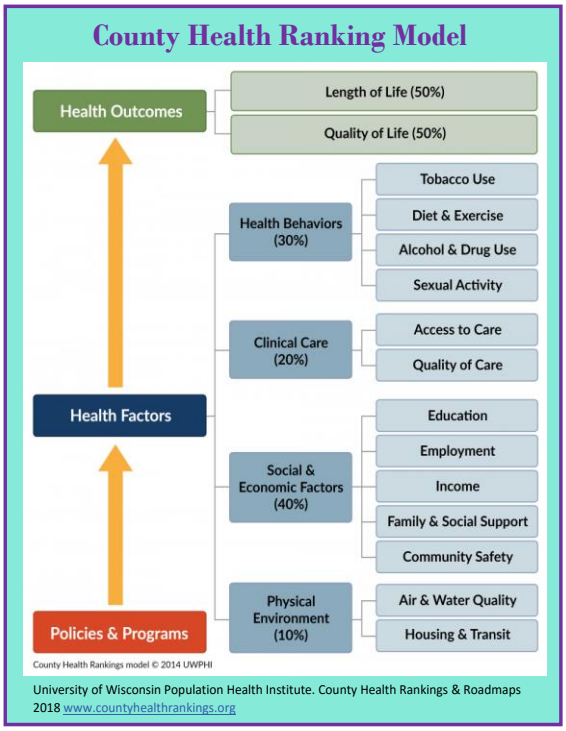
48% of Children in St. Louis City were Tested for Lead in 2017



Approximately 11,610 (48%) of 24,120 children living in St. Louis City under the age of 6 were tested for Lead poisoning in 2017.

Although the state of Missouri mandates that all St. Louis City children under 6 be screened, significantly increasing the screening rates has been difficult. The Department of Health (DOH) provides some screening but lacks the capacity to test all 24,000 children and relies on primary care physicians to screen for lead. One of the difficulties in screening all City children is a perception by physicians that some children are not at risk. Some areas of the City, particularly the southwestern regions, have had historically lower rates of lead poisoning. Not all homes in the areas with low prevalence rates are free of lead hazards, however; it cannot be assumed that these children do not face a risk of lead exposure. Additionally, many physicians assume there is no need to screen for childhood lead poisoning past the age of 2, since that is the age at which children are most likely to be lead poisoned. This is not accurate, as a cohort study found that 8.1% of children not lead poisoned at age 2 were found to be lead poisoned at a later age. Of children with undetectable levels of lead in their blood at ages 1 and 2, 30% had a level of at least 5 μg/dL later. St. Louis City has one of the highest percentages of children screened for lead poisoning in the state, but there still remains a need to increase screening of all children through age 6.

Determinants of Health



Healthy People 2020 has identified Determinants of Health as a range of personal, social, economic, and environmental factors that influence health status. The interrelation of these factors determine the health of an individual and the population. The determinants fall under the categories of biological and genetic makeup, individual health behavior, access to health services, social interactions and norms, and the physical environment. Examples include: stress, work environment, unemployment, education, transportation, public safety, and housing. Brooske, B, et. al (2010) researched how much each determinant contributed to health outcomes and assigned weights to each as shown in the diagram to the right which is known as the County Health Ranking Model. The Model shows that the population's health is shaped 30% by Health Behaviors, 20% by Clinical Care, 40% by Social and Economic Factors, and 10% by the Physical Environment. As part of Surveillance activities, other factors such as described determinants of health, are monitored and analyze to identify trends or contributing factors to lead poisoning. By evaluating data and looking at data through a health equity and racial equity lens, we can focus attention on the upstream factors, systems, policies, and practices that can be improved upon for optimal health in our communities.

Data Collection & Limitations

Surveillance data is subject to limitations in measurement and analysis, and the reported findings must be interpreted with caution. Screening for lead poisoning in the City of St. Louis is weighted towards those at greatest risk, and the rates in this report are likely higher than true population rates. Currently, only approximately 48% of the children under 6 years of age in St. Louis City are tested for lead poisoning. While it is possible that some of the missing 52% of children not tested is due to under reporting to the Health Department, it is likely that the majority of these children were not screened for lead exposure in 2016. Furthermore, providers may choose not to test children in later years because they do not consider them to be at great risk.

There are many instances were data is not available, or is limited in scope, particularly at the local level. Often the data at the neighborhood, ward, or zip code levels are in such low numbers that it would violate confidentiality rules to report such data. In these instances, there may be several years of data aggregated together, or the data may be reported for a larger area and population.

This report differs from some previous reports due to changes in 2012 to CDC's definition used to identify children with elevated exposure to lead. What was originally termed "level of concern" with a blood lead level of $\geq$10 μg/dL, is now $\geq$ 5 μg/dL and termed "reference level" This report will present childhood lead poisoning using the new "reference level", but will include some data at the original "level of concern" to allow for comparison with prior reports and other data sources.

Some data used in this report is collected by surveys or may be preliminary data, and should be considered estimates as there is an inherent margin of error.

CDC's Surveillance Definitions and Classifications:

Test: Any blood lead draw (capillary, venous or unknown sample type) on a child that produces a quantifiable result and is analyzed by a Clinical Laboratory Improvement Amendments (CLIA)-certified facility or an approved portable device. A blood lead test may be collected for screening, confirmation, or follow-up.

Screening test: A blood lead test for a child age <72 months who previously did not have a confirmed elevated BLL. (NOTE: A child may be screened in multiple years or even multiple times within a given year, but would be counted only once for each year.)

Elevated BLL: A single blood lead test (capillary or venous) at or above the reference range value of 5 µg/dL established in 2012.

Confirmed elevated BLL ≥ 10 µg/dL: A child with one venous blood specimen ≥ 10 µg/dL, or two capillary blood specimens ≥ 10 µg/dL drawn within 12 weeks of each other.

Unconfirmed elevated BLL ≥ 10 µg/dL: A single capillary blood lead test ≥ 10 µg/dL, or two capillary tests ≥ 10 µg/dL drawn more than 12 weeks apart.

Percent of children with elevated BLLs: The number of children less than 72 months of age with an elevated blood lead level ≥5 µg/dL divided by the number of children less than 72 months of age tested for blood lead, multiplied by 100. Also referenced as "Case Rate."

Percent of children tested: The number of children less than 72 months of age tested for blood lead divided by the total number of children less than 72 months of age based on 2000 (years) or 2010 (years) U.S. Census data, multiplied by 100.

Classifications

- Once a child has had one confirmed elevated BLL, if in subsequent years he or she has another elevated test result, regardless of the test type, we include that child in the tables showing the number of children with confirmed elevated BLLs for each year he or she continues to have an elevated BLL test result (prevalence data).
- However, a child is counted only once for each year in which he or she is tested and has an elevated BLL. In a subsequent year, if a child with a confirmed elevated BLL has no follow-up test or only follow-up tests that are below 5 µg/dL, the child would not be counted with confirmed elevated BLLs for that year.

Source: https://www.cdc.gov/nceh/lead/data/definitions.htm

Ward Highlights

Wards most at risk for lead poisoning are ranked below from highest risk to lowest risk:

Blood Lead Poisoning by Ward in Children 0-5 Years of Age, 2017			Estimates		Actual Numbers
2017 Rank #	Ward #	2017 Case Rate ≥5 µg/dL	Estimated Population of Children under 6	Estimated Children with Lead Poisoning**	Number Children 0-5 Years of Age Tested for Lead Poisoning in 2017
1	20	14.3%	810	92 - 139	491
2	21	11.9%	801	77 - 115	360
3	1	11.1%	751	67 - 100	306
4	4	10.2%	681	56 -84	352
5	9	10.0%	861	69 - 104	359
6	25	9.7%	886	69 - 103	516
7	15	8.5%	915	62 -94	387
8	26	7.7%	844	52 -78	339
9	22	7.5%	707	43 -64	479
10	2	7.4%	787	46 -70	271
11	3	7.2%	644	37 -56	374
12	8	7.1%	827	47 -71	337
13	14	7.1%	909	52 -78	422
14	28	7.0%	895	50 -75	100
15	11	6.8%	912	49 -74	354
16	18	5.6%	831	37 -56	303
17	27	5.5%	747	33 -50	343
18	13	5.0%	913	36 -54	383
19	5	3.8%	919	28 -42	550
20	6	3.0%	1084	26 -39	437
21	17	2.9%	917	21 -32	137
22	7	2.9%	1106	26 -38	242
23	12	2.6%	933	19 -29	313
24	19	2.5%	943	19 -28	244
25	10	1.9%	911	14 - 21	258
26	24	1.7%	893	12 - 18	242
27	23	0.8%	909	6 - 9	382
28	16	0.8%	931	6 - 8	398

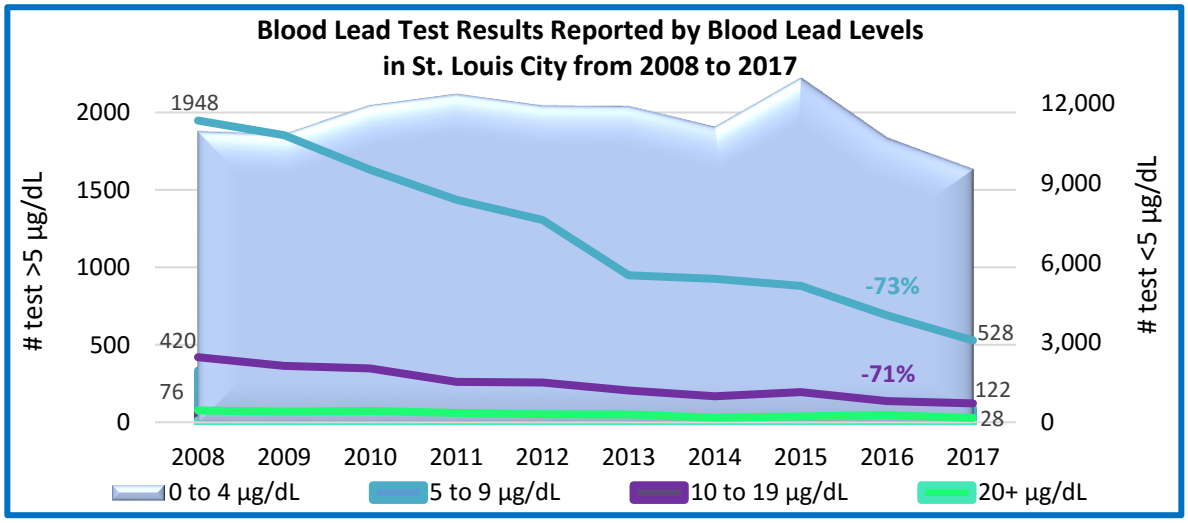
*Estimated children under 6 years of age per ward based on 2010 census at 7.6% of the City's population under 6 yrs, multiplied by population of Wards

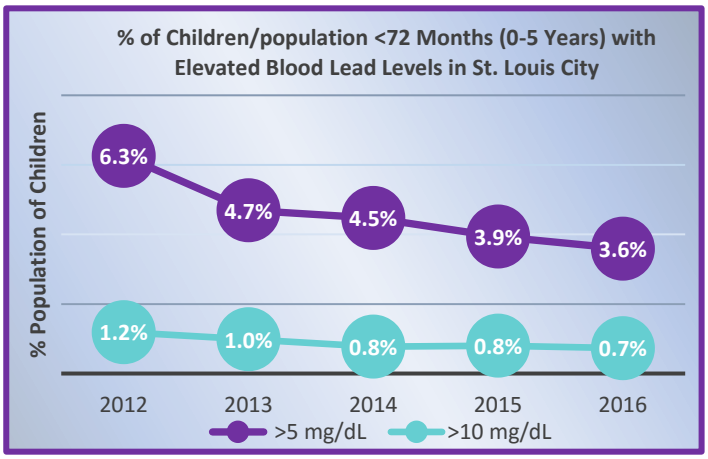
**Estimated children with lead poisoning is calculated using the screening prevalence rate times the number of estimated number of children under 6 Years per ward, and calculated range at +/- 20%, Note: Actual numbers ≥5 µg/dL by ward are too low to report, and some 2017 data is still pending

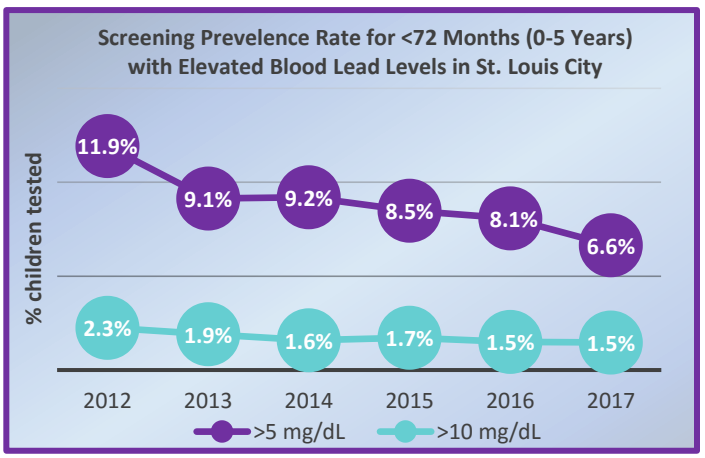
Lead Prevalence

Prevalence rates define the widespread condition of a disease in a given population at a given time and is calculated by the dividing the number of cases by the total population. With Lead, it is common to use a Case Rate, or "Percent of children with elevated BLLs" the number of children <6 years with an elevated blood lead level ≥5 µg/dL is divided by the number of children <6 years tested for blood lead, multiplied by 100. The "reference value" set by CDC for determining elevated blood level is currently 5 µg/dL of Lead, which is lowered from 10 µg /dL back in 2012. The graph below shows the number of test results reported, with a 73% decrease in lead levels above 20 µg/dL, a 71% decrease in levels between 10-19 µg/dL, and a 63% decrease in levels between 5-9 µg/dL from 2008 to 2017. The graph at the bottom of the page shows a decline in the screening prevalence rate of children <72 months with elevated blood levels (at both reference values of 5 µg/dL and 10 µg/dL) in St. Louis city from 2012 to 2016. The screening prevalence rate for Missouri in 2015 for reference level 10 µg/dL was .65%, and for reference level 5 µg/dL was 3.8, compared to St. Louis City at 1.7% and 8.5% respectively the same year. This 2017 data is preliminary, as the data is often reported late by some providers and this data will be adjusted at a later date. This data includes those who test elevated for the first time (incident cases) and those who had been previously diagnosed (prevalent cases). It is difficult to reduce the lead level in children, especially if continued exposure occurs; elevated levels may persist for some time unless aggressive measures are taken.

Number of Children Screened for Lead Poisoning, 2008-2017

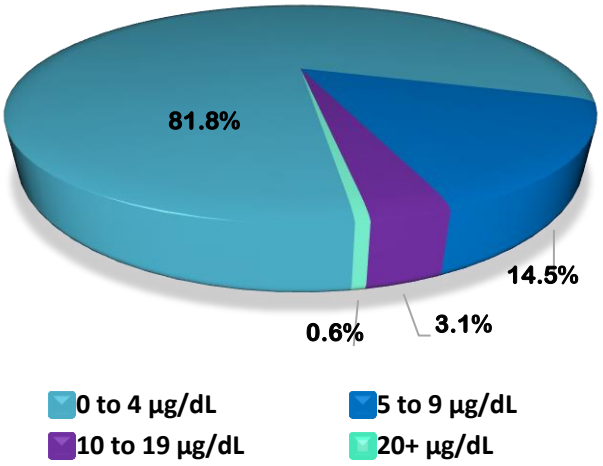




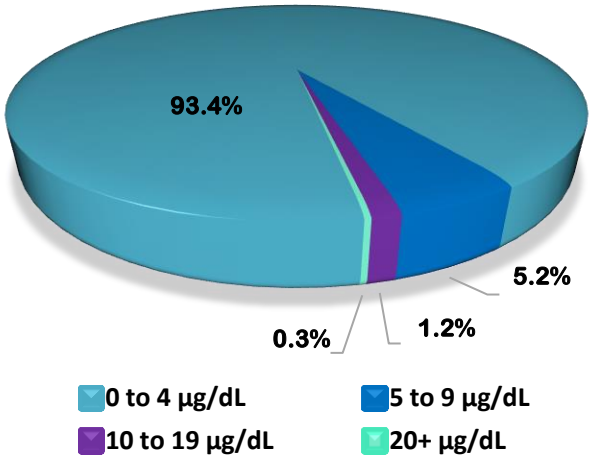


Of the 678 cases of lead poisoning in 2017, 422(62%) of those children were new or "incident" cases. These are children who have either never been tested before or had been tested and had a blood lead level below the threshold. The screening incidence rate (SIR) is the number of new cases of lead poisoning divided by the tested population who had never been poisoned before. The SIR for 2017 is 4.3%. The below charts compare the screening incidence rates of various blood lead level groups in 2008 to 2017. The 2017 data shows that the number of new cases with higher lead levels are decreasing.

Screening Incidence Rates by Blood Lead Level Groups Reported St. Louis City for 2008



Screening Incidence Rates by Blood Lead Level Groups Reported for St. Louis City for 2017



Demographic Analysis

Understanding the demographics of the city is critical to determine what diseases are appearing and where, and helps to identify or understand trends that are impacting specific populations due to age, race, income, environmental factors, etc.

2017 Demographics of Childhood Lead Poisoning
(updated 3/28/18)

BBL Levels:	<5 µg/dL	5-10 µg/dL	10-19 µg/dL	>20 µg/dL	All Elevated >5µg/dL
Children <6 yrs	93.4%	5.2%	1.2%	.27%	6.6%

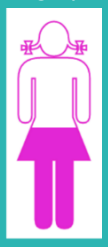
Children <6 yrs with elevated lead >5 µg/dL:

Age:

	#test	% >5µg/dL
< 12 months	158	1.9%
12-23 months	2769	6.8%
24-35 months	2024	9.9%
36-47 months	1950	6.2%
48-59 months	2056	5.2%
60-71 months	1255	4.6%

Gender:

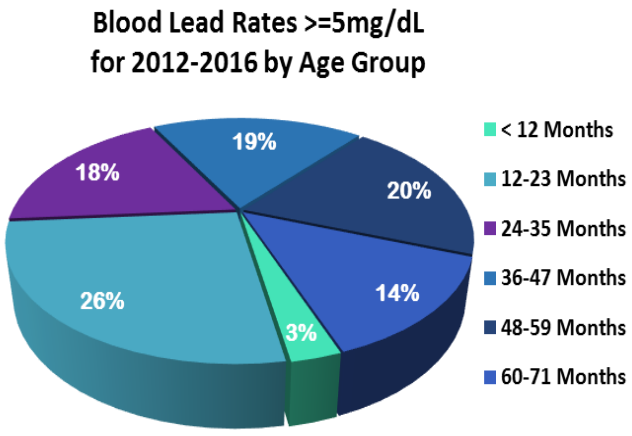
Females 49.7%

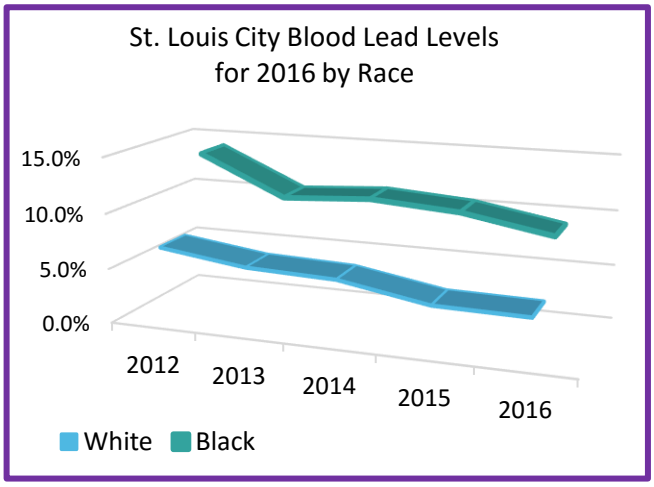


Males 50.3%

Age

Age is one of the most important demographic indicators for lead poisoning, as it shows us that lead occurs primarily in certain age groups. Children are typically at higher risk for risk of lead poisoning when they are around two years of age, as children begin exploring their environments, yet often have poor hand- washing skills. In St. Louis City, lead poisoning is occurring at high rates in children up to six years of age. The graph below to the left shows a five year distribution of lead poisoning by age group for the St. Louis City. It show that although 12-23 month old children account for 26% of the lead cases, children ages 60-71 months account for 14% of the lead poisoning cases in St. Louis. Data from this time period shows that ages 48-59 months had higher percentages of lead poisoning than the 24-35 month age group.



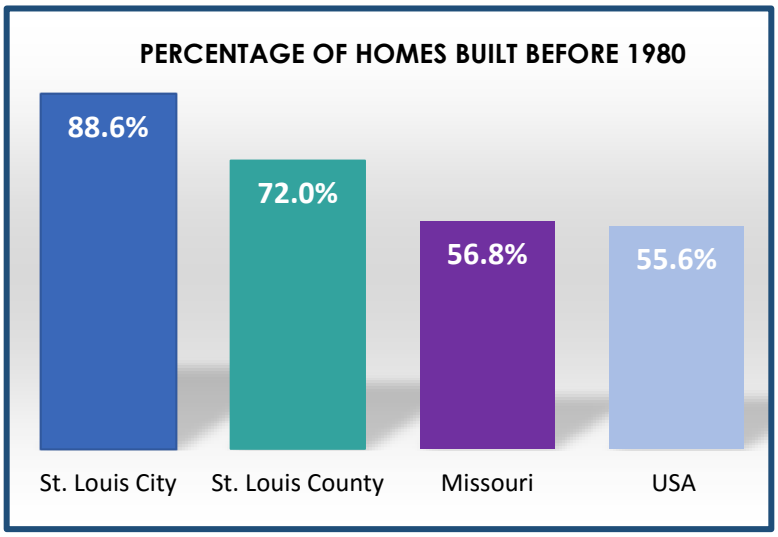


Race

In 2016, almost 60.1% of the children screened for lead poisoning were African American. However, African American children accounted for over 70.7% (613/867) of the children testing at blood lead levels greater than or equal to 5 µg/dL, and 64.0% of the blood lead levels over 10% µg/dL. Black children are 2.4 times more likely to test positive for lead in their blood than white children in St. Louis City. Race itself is not an indicator of lead poisoning, but rather other factors associated with health and racial inequities, such as poverty, poor housing stock, policies that impact home ownership, etc.

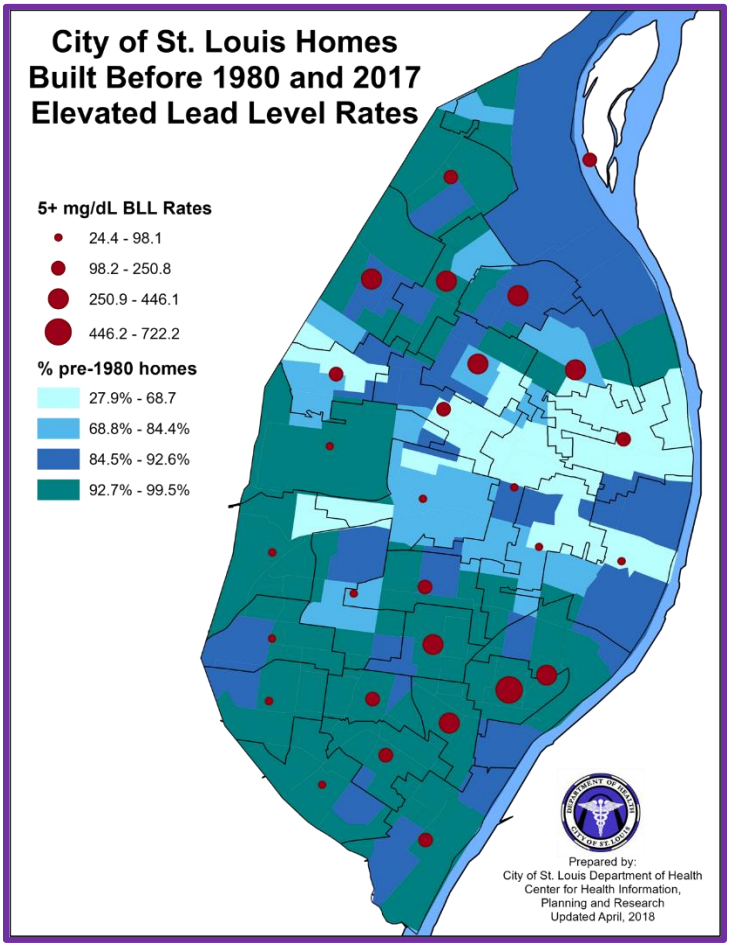
Environmental Analysis

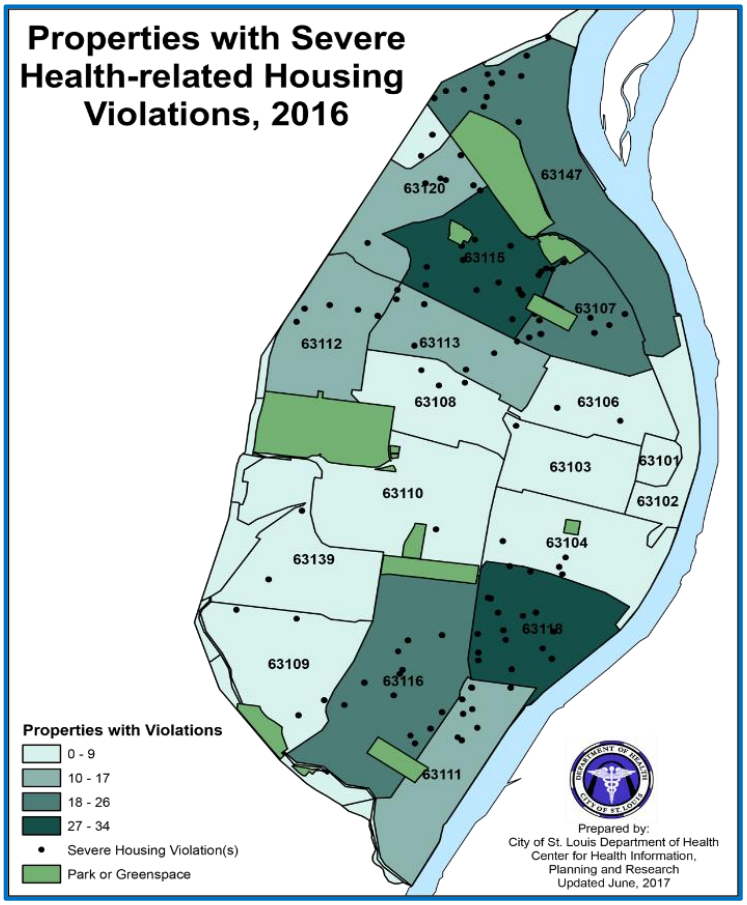
Lead is a naturally occurring element and can be found in the air, soil, water, and even inside our homes. Although lead and lead compounds are not widely used since the banning of lead-based paint and discontinued use of leaded gasoline, they are still in our environment. Deteriorating, chalking, peeling, cracking paint can lead-contaminated dust. Often old windows, door frames, and stair railings are found to be sources of lead poisoning. Deteriorating exterior lead-based paint or unsafe renovations can contaminate the soil and air around your home. Some old plumbing materials were made from lead, and lead has been known to leach into the water.



Note: Graphics represent the year individual structures were originally constructed. This includes occupied and vacant units and does not refer to any remodeling, additions or conversions.

In the City of St. Louis, 55% of structures were built in the 1930s or earlier. Lead paint was banned for use in housing in 1978, and all homes built before 1978 likely contain lead paint. 88.6% of homes in the City of St. Louis were built before 1980. Overall, the percentage of older housing stock is higher in St. Louis City than the county, state, and national average. The map to the right shows that the age of the housing stock does not necessarily correlate to the higher rates of lead poisoning in certain areas of the city. The majority of the city has pre-1980 housing, but the blood lead rate is very low in the some sections of the city. In a considerable portion of St. Louis dwellings, paint is chipping and turning into dust, which creates a dangerous situation. Lead in dust from lead paint in older homes is the main cause of USA preschool lead exposure today. Poor, urban minorities disproportionately reside in housing units containing lead-based paint hazards, creating significant health inequities.





This map shows of health-related housing violations by ZIP code area. The more serious health-related housing violations are marked with black dots. These health-related violations are found by the Health Department's Environmental Health Officers whose duties include investigating environmental health concerns, educating the community on health hazards, and enforcing health ordinances. If you compare the areas of high lead rates (red dots) on the map on page 13, to the darker green areas on this map, you will notice the same general areas impacted by high lead poisoning rates are also areas of increased housing violations.

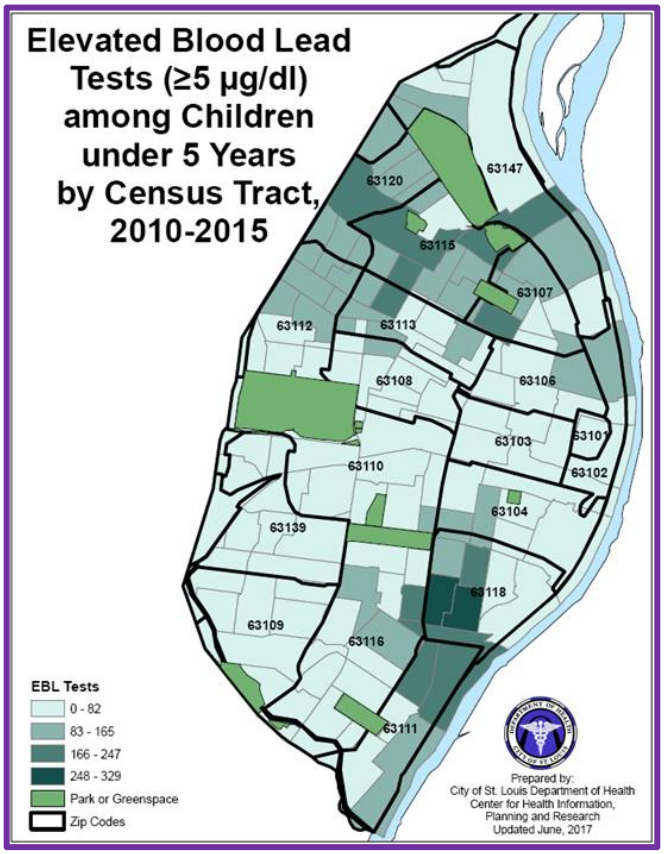
Years ago, an old federal "redlining" policy deemed certain areas unsafe for home loans, and unfairly impacted the black population and their ability to become home owners, and ultimately contributed to the concentration of poor people in specific neighborhoods to the north and south-east living in substandard housing conditions. Poor, urban minorities disproportionately reside in housing units containing lead-based paint hazards, creating significant health inequities. Areas with older deteriorated housing stock generally have lower socioeconomic status and higher rates of lead poisoning than more affluent areas. Although, the majority of homes in St. Louis City are pre-1980, there are certain areas with older housing and families with higher incomes that have lower case rates of lead poisoning. Indicating that it is more than just the age of housing stock that impacts the rate of lead poisoning, and that housing maintenance and safe housing conditions are important in reducing lead exposure.

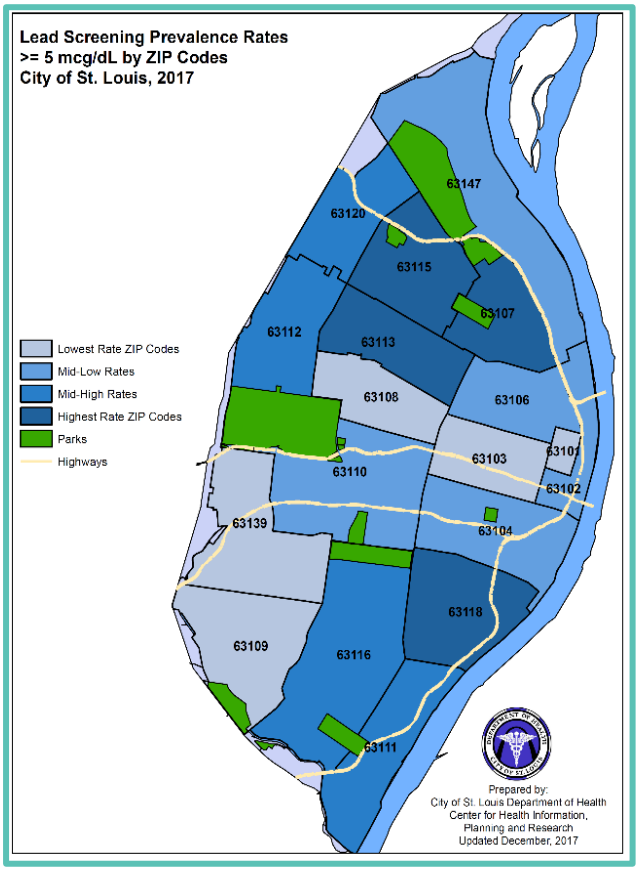
Seasonality

Lead poisoning can occur any time of year, but higher rates are typically seen in the warmer months. Several factors may contribute to this pattern. Playing outside may expose children to lead dust in the soil. Contaminated dirt tracked into the house by others may lead to higher rates. Many families, especially those without air conditioning, open the windows in warmer months. This could lead to higher lead poisoning rates in two ways. First, the friction of opening and closing windows painted with lead paint can create additional lead paint chips and dust. Second, opening windows allows wind to blow through a house, which could exacerbate exposure to airborne lead dust.

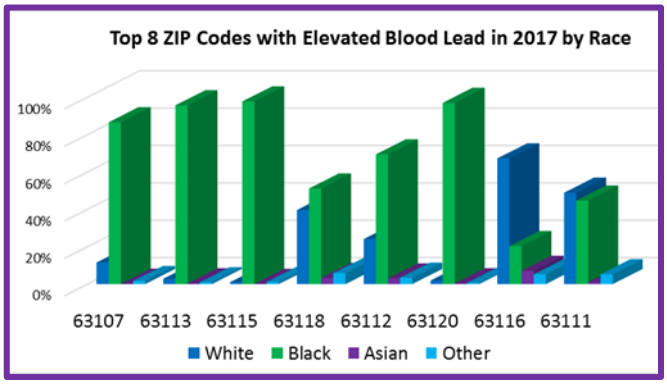
Geographical Analysis

The maps in this section view lead poisoning based on CDC's current "reference level" of ≥5 µg/dL, unless otherwise noted. The use of geography in lead poisoning surveillance assists the Health Department in developing targeted programs in high-prevalence areas, as well as analysis of lead poisoning at a local scale. Maps can help local leaders understand the lead problem and how it affects their communities, their wards, and their neighborhoods. Data is used to motivate policy makers in participating in prevention activities, to develop lead-prevention policies, and to allocate necessary resources to eliminate lead poisoning. The map to the right shows the zip code areas with the highest blood lead levels based on a five year period from 2010-2015. The background lighter gridlines highlight the census tracts within the city limits. There are 18 ZIP Codes completely in the City of St. Louis, and a few on the fringe that are shared with St. Louis County.

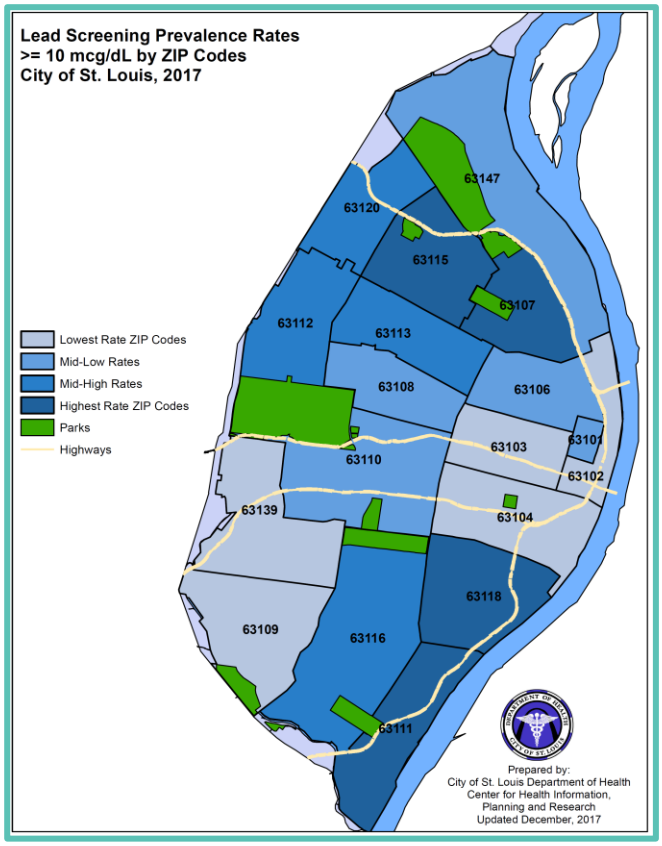


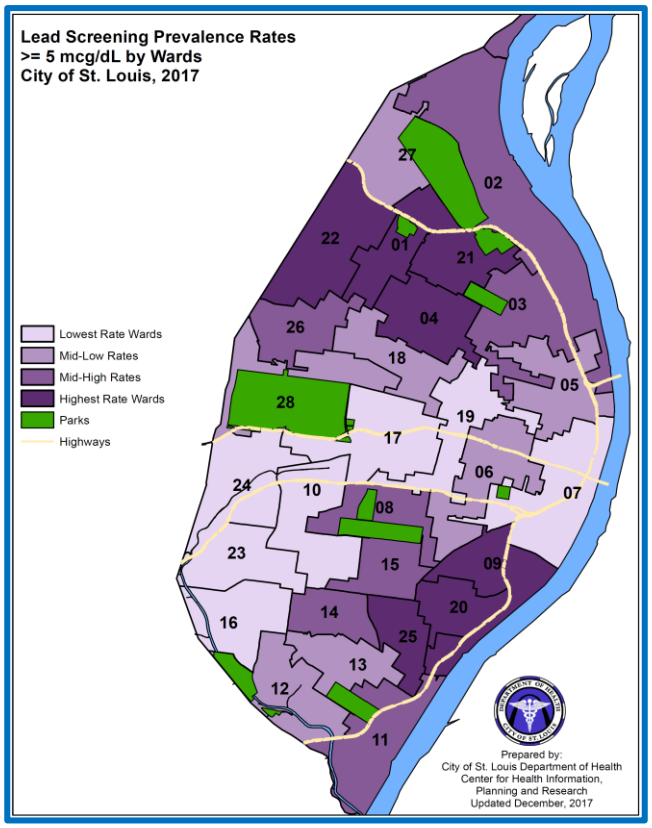


In the map above, you can see that at the census level, there are portions within some ZIP codes that have higher rates than others. Delving deeper into the specific zip codes may help to identify what in that neighborhood may be attributing to the higher lead levels. Although this is a five year map, lead poisoning has been occurring much longer and the rates continue to be higher in the northern section of the city and southern along highway 55. The map to the left shows the ZIP Codes with the highest rates of elevated blood levels in 2017 in darker blue. The population of these ward also indicate racial segregation, which is a factor that often leads to health inequities.



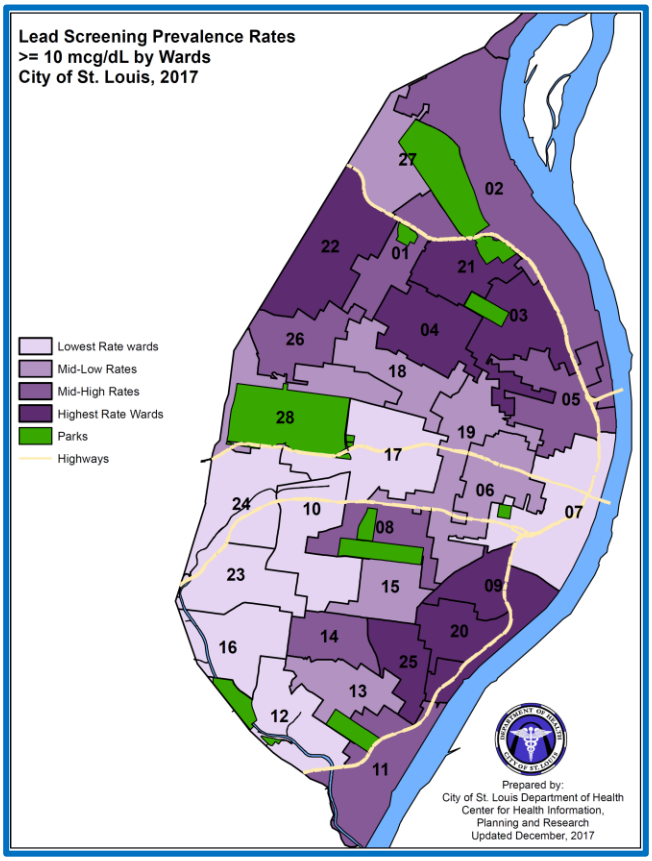
In the map to the right, are the ZIP Codes with the highest rates of elevated blood levels ≥10 µg/dL (old reference level) highlighted in the darkest blue which include ZIP codes 63118 (3.8%), 63107 (3.5%), 63112 (3.4%), 63115 (2.9%), and 63111 (2.9%). Some ZIP Codes, including 63101 and 63102, have very small populations of children under age 6, and blood level rates must be interpreted with caution.





There are 28 aldermanic wards in St. Louis City. Wards with the highest rates of CLP using the new reference level (BLL ≥5 µg/dL) in 2017 were Ward 20 (14.3%), Ward 21 (11.9%), Ward 1 (11.1%), Ward 4 (10.2%), Ward 9 (10.0%), and Ward 25 (9.7%).

There were 26 children with blood lead test higher than 20 µg/dL in 2018, and 114 higher than 10 µg/dL. Ward 20 continues to remain in the number one spot for the ward with the highest number of blood lead poisonings. Wards 21, 1, 4, 9, and 25 also rank in the top 25% of wards with high lead levels. Wards 16, 23, 24, and 10 have less than 2% of the children testing positive for blood lead.

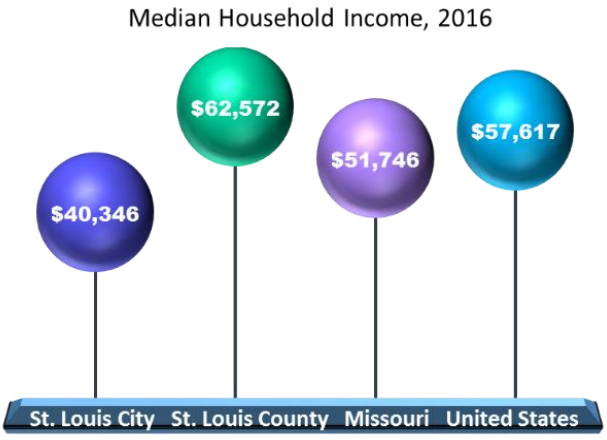


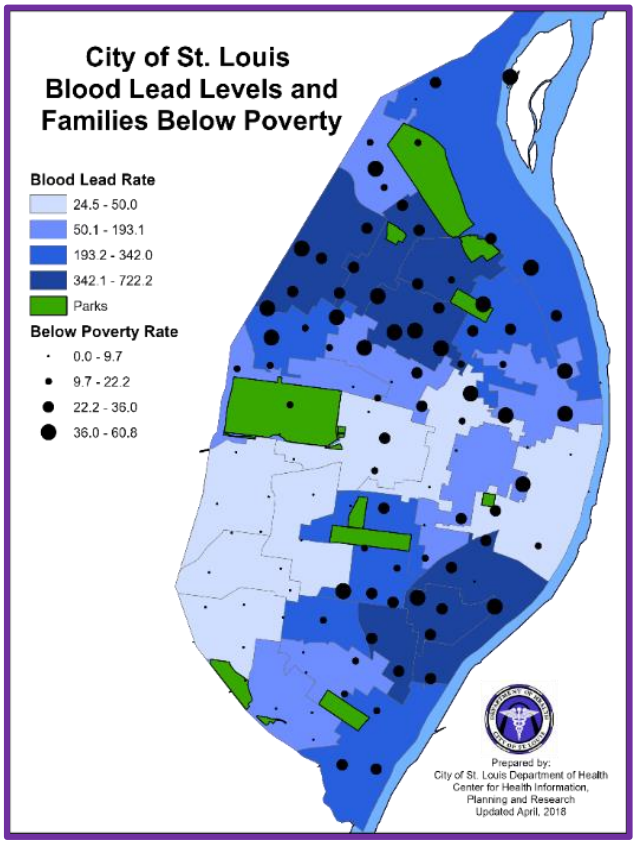
Socio-economic Analysis

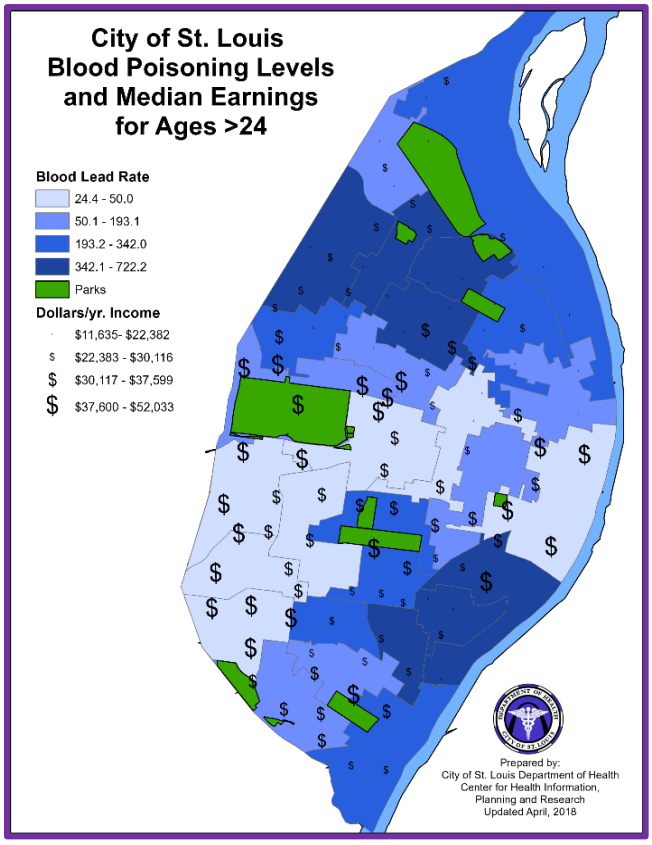
Social and economic factors have a strong influence on a person's health and consist of factors such as education, employment, income, family and social support and community safety. According to the County Health Ranking Model, 40% of a person's health is influenced by these factors. Not only are Social and Economic Factors the largest contributors of health outcomes, but they also influences health behaviors, the second greatest contributors to health. Traditionally, children of lower socioeconomic status have been more likely to be screened for lead exposure in the City of St. Louis, largely due to the screening practices of experienced community health centers. Poor areas tend to be targeted for lead screening and education more than affluent areas due to higher case rates in underprivileged areas.

Income and Poverty

Higher income and social status are linked to better health. The greater the gap between the wealthiest and poorest people, the greater the differences in health. The median income in St. Louis City is $35,599, much lower than the state at $48,173, the St. Louis County at $59,520, and nationally at $53,889. The map below shows the areas of high poverty rates with the larger black dots. The dark blue areas represent areas with high lead rates. There are much lower lead rates in area of higher income.





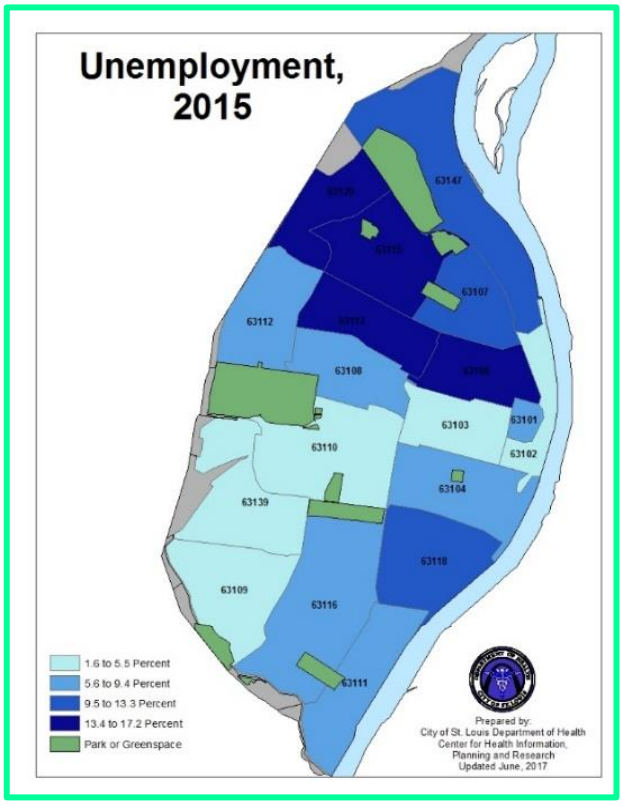


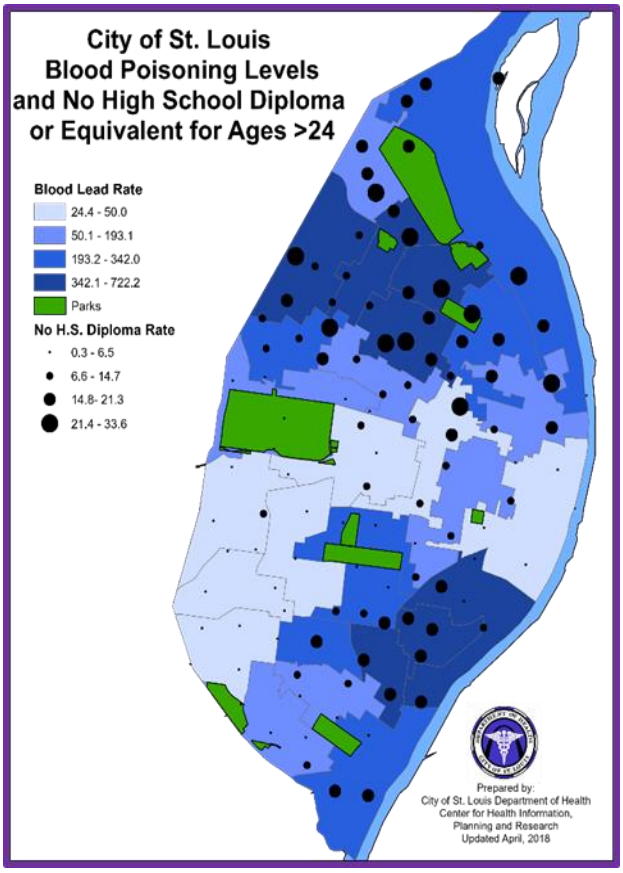
Employment and Education

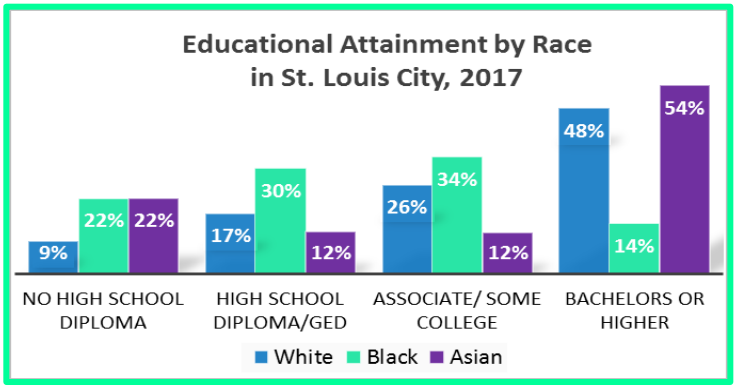
Education is linked to knowledge, behaviors, employment, and income. Having a good education comes with inherent social and psychological benefits, improved control over life circumstances, informed choices, improved health outcomes, problem solving skills, increased knowledge, and an increased earning power as level of education increases. Needleman et al. (1996) examined schoolchildren between 7 and 11 years of age who had a clinical diagnosis of lead poisoning at an early age and found worsening of behavior patterns as the children with high BLLs got older.

There is much well-established research on childhood lead poisoning and its impacts on cognitive and behavioral impairments. Even at low lead level, lead exposure can lower a child's IQ. Lower education levels are linked to stress, lower self-confidence, increased behavioral issues, poverty, unemployment, and poor health. Cohen et al. (1998) reports that dropping out of high school leads to lower lifetime earnings and increased criminal activity.

Northern areas of St. Louis City show unemployment rates between 9.5% and 17.2% in 2015. If you compare the light and dark shading of blue in the unemployment map to the right with the maps below of persons with no high school diploma, the higher rates are in the same areas. According to US Census data, the rate of poverty generally decreases as the level of education increases, and approximately 26% of those who do not complete high school are below the federal poverty line as compared to 8% of residents who have completed a bachelor's degree or higher. Even at low lead levels, lead exposure can lower a child's IQ and lifetime earnings ability.

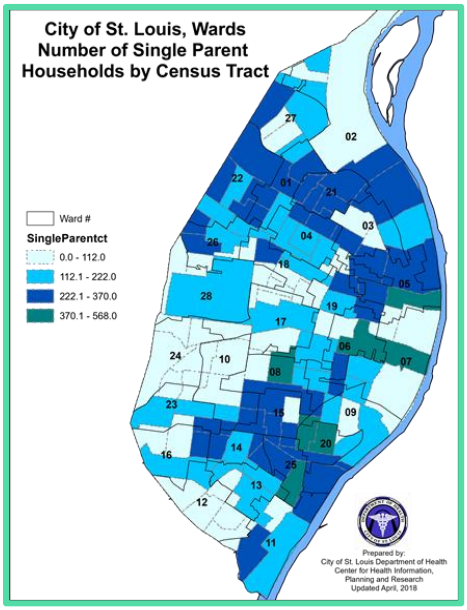


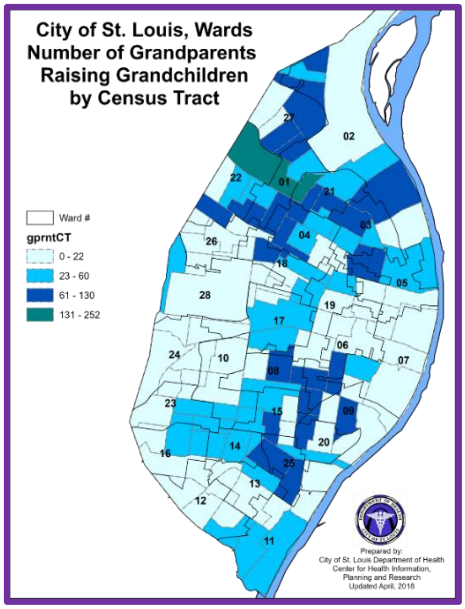


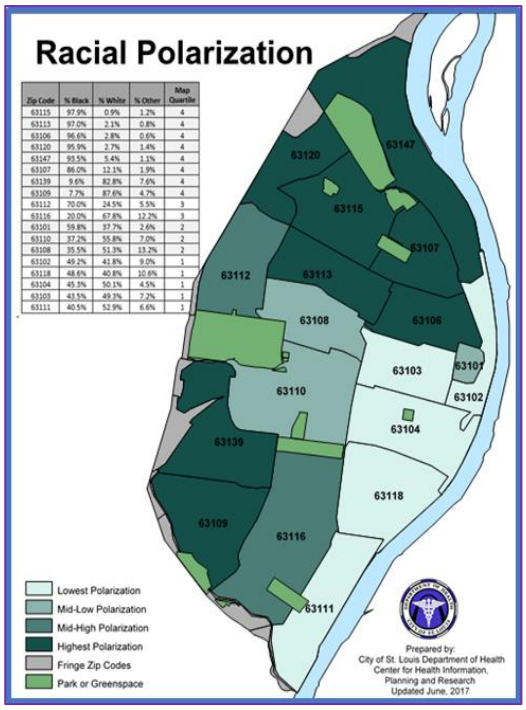


Family & Social support

Health outcomes are influenced in myriad ways including by an individual's family structure, and their social environment and community. There are several indicators that help to identify when these systems start to break down and impact the health of the population. Teen pregnancy, infant mortality, crime, and lead poisoning are just a few. In the map to the right, the dark blue areas represent the highest number of single parent households. Many single parents have to work long hours to earn enough for running a home and raising children. Often financial limitations or uncontrollable situations resulting from a breakdown of the family structure, and can result in an unsafe living environment and potential lead exposure. The map to the far right, shows many similar areas in the city also have a high number of grandparents raising grandchildren. Research has indicated that moderate levels of childhood lead exposure can greatly increase a child's propensity for risk-taking activities. For instance, Lane et al. (2008) found that blood lead levels > 20 µg/dL are strongly linked to repeat teenage pregnancies and cigarette smoking among low-income youth. Family support systems are essential during child development and to build resiliency, and a good family structure and social support system can minimized stressor and potential health hazards.

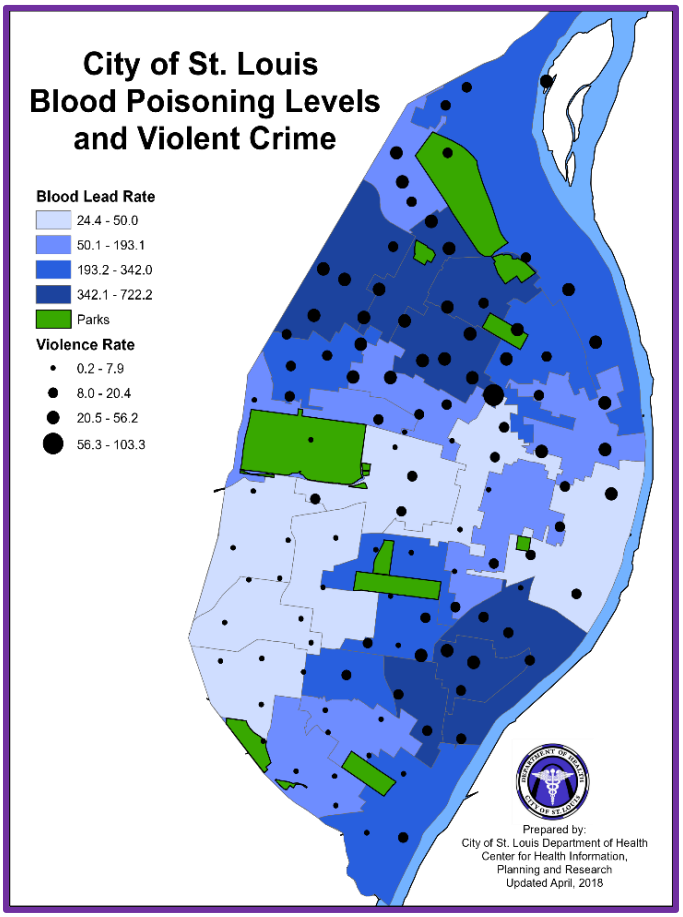






St. Louis City is racially polarized with the black population residing primarily on the north side, and most of the white population residing on the south side. This creates a form of "institutional racism" and leads to health disparities that persist over time due to a variety of issues such as low socioeconomic status, lack of resources and opportunities, governmental policies, neighborhood conditions, employment resources, etc. These complex issues can ultimately lead to inadequate and unsafe housing, which can then increase the potential for lead poisoning. If we would ask, "why would someone live in inadequate and unsafe housing?", then we would start getting at the root of the public health issue, or the "social factors". Social connections, or the lack thereof, can influence health via direct and indirect pathways, and it is necessary to understand a person's life circumstances to understand how to make cultural changes to improve the health of a population. Public health has made great strides in reducing lead poisoning, but it continues to be an ongoing problem. No lead exposure is a safe level, and to address the health inequities in our community, we need to address the fundamental cause which led to the exposure to the risk factor.

Community Safety & Violence



Examining data both upstream and downstream is necessary to improve health disparities. All children need to feel safe in their communities, and their communities need to thrive in order for that to occur. The map at the right shows blood poisoning rates, with the highest rates in darker blue, and it shows the violence rates in black dots that increase in size as the rates increase. The higher rates of lead poisoning correlate to the darker areas of blue, while the rates are lower in areas of low blood lead rates. Although there is no local research on St. Louis City to evaluate any correlation between our violent crime rates and criminals having prior exposure to lead, there is research which suggests that it is plausible.

Lead poisoning can cause nerodevelopmental damage to a child during their developmental years, and impact their IQ, education, and behavior. Bellinger et al. (1994) found that increased lead exposure correlates strongly with social and emotional dysfunction. Denno's (1990) research found childhood lead poisoning leads to future aggressive and criminal behavior, and that it was one of the most important determinants of disciplinary problems from ages 13 to 14, juvenile delinquency from ages 7 to 17, and the number of adult offenses from ages 18 to 22.

Nevin (1999, 2000) examined the variation of childhood gasoline lead exposure from 1941 to 1986 and explained that nearly 90% of the variation in violent crime rates from 1960 to 1998; and the reduction in use of lead paint explains 70% of the variation in murder rates from 1900 to 1960. Implementation of the Clean Air Act and the resultant drop in lead poisoning in the 1970s and 1980s accounts for one-third of the drop in crime throughout the 1990s (Reyes 2007),

Both the age at which a child is exposed to lead, and the amount of lead concentrations at which they were exposed influences the degree to which a child's health is affected. Needleman et al. (2002) showed that adjudicated delinquents are four times more likely to have blood lead concentrations > 25 ppm than no delinquent adolescents.

Financial Costs Related to Lead Poisoning

There are many financial costs associated with the effects of lead exposure, in addition to medical cost related to testing and treatment. Economic and Social cost include special education associated with reduced cognitive abilities, reduced earning potential, loss of tax revenue, increased welfare dependency, and violent criminal behavior. There are public health cost related to prevention and educational activities to decrease the likelihood of lead exposure and increase the testing for lead poisoning; costs for advocating for policies and laws to reduce lead exposure, cost associated with enforcing public health laws; and cost associated with remediation of lead hazards in homes and the environment. Although there is a cost for public health prevention activities, Gould, E (2009) estimated that for each dollar invested for controlling lead hazards, the return is $17-$221, or a net savings of $181-$269 billion in health benefits, increased IQ, higher lifetime earnings, tax revenue, special education, and criminal activity.

Gould, E (2009) estimates that direct cost of lead-linked crimes in the United States is $18 billion, and a 1 µg/dL reduction lead level in a pre-school child will results in 116,541 fewer burglaries, 2,499 fewer robberies, 53,905 fewer aggravated assaults, 4,186 fewer rapes, and 717 fewer murders. The total direct cost include victim costs, costs related to the criminal justice system through legal proceedings and incarceration, and lost earnings to both criminal and victim. Indirect cost are not included in these figures, but would be approximately an additional $11.6 billion, which include savings from psychological and physical damage necessitating medical treatment and preventive measures resulting from the criminal action.

Kemper et al. (1998)[1] also estimated costs of screening and treatment as follows (inflated to 2018 USD using the overall Consumer Price Index): venipuncture ($9.94), capillary blood sampling ($4.95), lead assay ($26.52), risk assessment questionnaire ($3.05), nurse-only visit ($48.72), physician visit ($121.81), environmental investigation and hazard removal ($510.07), oral chelation ($357.81), and intravenous chelation ($2806.15). These costs have been inflated to March 2018 USD using the overall Consumer Price Index, an arguably conservative estimate of medical inflation because medical costs have increased at rates significantly higher than general inflation over the past decade.

Calculating approximate cost in today's figures: For a screening test with nurse using the venipuncture method will cost approximately $85.73; for children with levels ranging from 5 to 9 µg/dL, further diagnostic testing is required, necessitating venipuncture and a lead assay, a risk assessment questionnaire, and follow-up visit, for a

[1]The costs used from Kemper et al. (1999, p. 1206) are as follows: venipuncture ($6.53), Capillary blood sample, ($3.25), Lead assay ($17.42), Risk assessment questionnaire (2.00) Nurse-only visit ($32), Physician visit ($80), Environmental investigation and hazard removal ($335), Oral chelation ($235), Intravenous chelation ($1843).

total cost of $173.96 per child; for children with levels ranging from 10 to 19 µg/dL, an additional lead test and follow-up visit, home visit, for a total of $271.40; for children with levels 20-44 µg/dL, additional follow-up visit with doctor, lab test for iron and hemoglobin/hematocrit, abdominal x-rays, and environmental investigation of the home in question for a total cost of $1486.28 per child; for children with levels of 45–70 µg/dL, the recommended regime includes all of the above, follow-up doctor visits, accompanied by oral chelation, for a total cost per child for approximately $3101.36. For children with levels ≥ 70 µg/dL, oral chelation is replaced with intravenous chelation and may have several follow-up visits for an approximate total cost of $4852.59 per child. These are estimates based on Kemper et al. (1998) and additional research into cost. There are potential hospitalization costs and follow-up doctor visits that may occur which are not included.

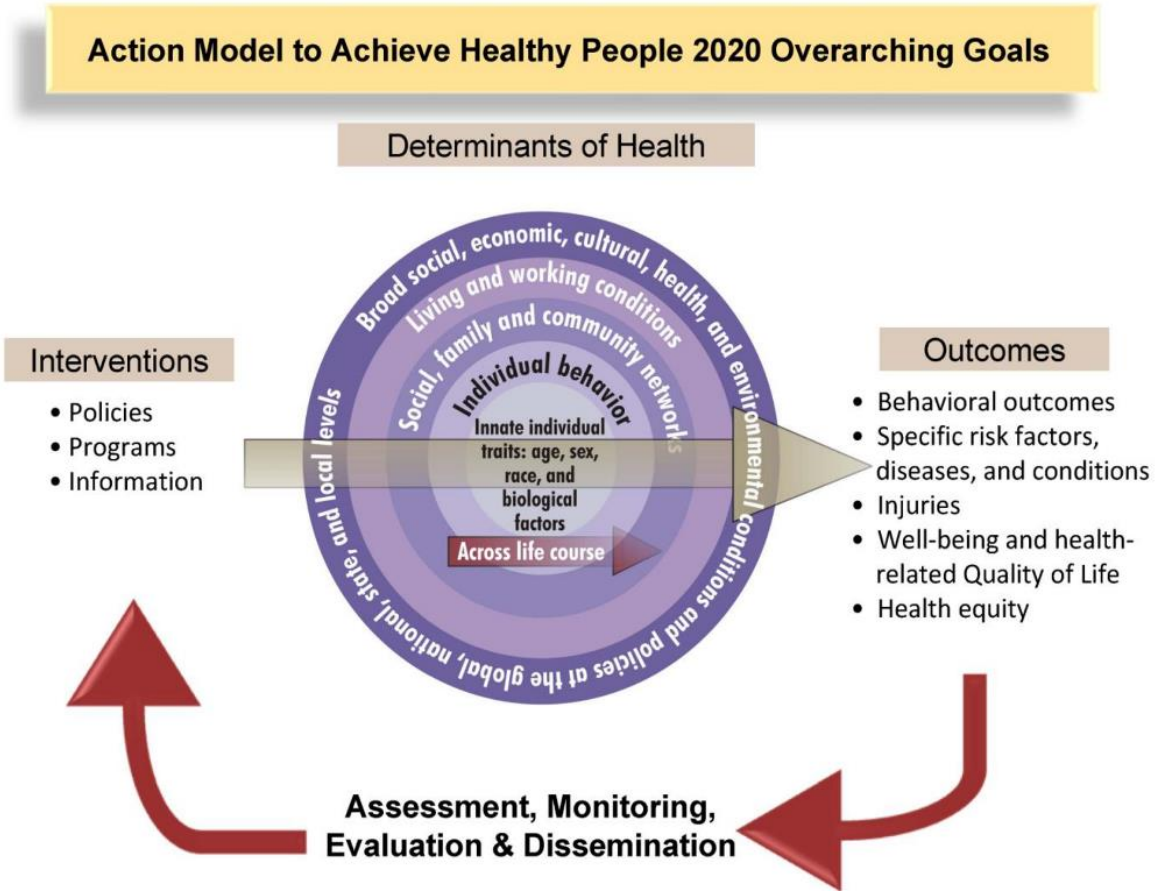
There can be substantial returns to investing in lead hazard control, particularly targeted at early intervention in communities most likely at risk. Given the high societal costs of inaction, lead hazard control appears to be well worth the price.

Estimated Cost for Treating Lead Poisoning in Children <6 Years of Age St. Louis City for 2013-2017

Blood Lead Level (µg/dL)	2013	2014	2015	2016	2017	Grand Total
5 to 9	$ 164,914	$ 161,087	$ 153,259	$ 120,032	$ 91,851	$ 691,143
10 to 19	$ 55,908	$ 45,595	$ 52,652	$ 37,182	$ 33,111	$ 224,448
20 to 44	$ 69,855	$ 40,130	$ 47,561	$ 62,424	$ 37,157	$ 257,126
45 to 69	$ 12,405	$ 3,101	$ 15,507	$ 9,304	$ 9,304	$ 49,622
70+	$ -	$ 4,853	$ -	$ -	$ -	$ 4,853
Grand Total	$ 303,083	$ 254,766	$ 268,978	$ 228,942	$ 171,423	$ 1,227,192

Summary and Recommendations

As discussed throughout this report, social and economic factors are the largest single predictor of health outcomes, more powerful than behavior, clinical care, and the physical environment. In addition, they can impact other determinants of health. Data collected shows that lead exposure disproportionately impacts lower income communities with higher minority populations. The preferred remedy for the lead poisoning problem is to prevent children from ever being poisoned in the first place through primary prevention. We must educate our community and policy makers that individually-based risk factors must be contextualized by delving into what puts people at risk for being at risk. We must also educate them about the fundamental causes of many increased health issues such as infant mortality, obesity, lead poisoning, teen pregnancy, violence, and drug usage, and that these stem from socioeconomic status and social support systems which need to improve in order to improve health disparities. We need to embody access to important resources and truly focus on population health, and the risk of imposing individually-based intervention strategies. These are ineffective and we are missing opportunities to adopt more broad-based societal interventions that could substantially improve our community. The Healthy People 2020 Action Model below is the recommended framework for moving forward in reducing lead poisoning among children in St. Louis City.



Developing goals in line with Health People 2020 and information gained from our Community Health Assessment to specifically increase resource allocation to improving health inequities is recommended:

1) Assess current policies that may be negatively impacting minority populations, and develop policies aimed at improving health equity and the social determinant of health,

2) Research and implement new internal programs and/or policies that are evidenced-based, and/or see how existing evidence-based programs can be improved upon to address health disparities,

3) Develop assessments or surveys that can improve upon the limited data available that can measure and monitor the social and community factors for improvements,

4) Partner with Washington University on researching the effects of lead on the children in St. Louis City and potential correlation to incarcerations and violent crimes within the city,

5) Develop a leadership role in understanding and maintaining a knowledge base of the resources and services available in our communities and identifying any gaps in those needed services. Improve partnerships with the schools, police, mental health, and community partners and target areas of the city that are suffering from the racial polarization,

6) Develop the workforce and their ability to communicate with the community and to routinely assess the root causes that lead to racial and health inequities as part of their normal daily job functions.

Below are Healthy People 2020 Objectives that should be considered in partnership with our stakeholders:

- Reduce blood lead level in children aged 1–5 year
- Increase the proportion of pre-1978 housing that has been tested for the presence of lead-based paint
- Increase the proportion of pre-1978 housing that has been tested for the presence of lead in dust
- Increase the proportion of pre-1978 housing that has been tested for the presence of paint-lead hazards
- Increase the proportion of pre-1978 housing that has been tested for the presence of lead in soil
- Reduce the number of U.S. homes that are found to have lead-based paint
- Reduce the number of U.S. homes that have paint-lead hazards
- Reduce the number of U.S. homes that have dust-lead hazards
- Reduce the number of U.S. homes that have soil-lead hazards
- Reduce the proportion of occupied housing units that have moderate or severe physical problems
- Proportion of children aged 0-17 years living with at least one parent employed year round, full time
- Increase the proportion of high school graduates who are enrolled in college the October immediately after completing high school
- Decrease school absenteeism among adolescents due to illness or injury
- Reduce the proportion of adolescents who have been offered, sold, or given an illegal drug on school property
- Reduce the rate of minor and young adult perpetration of violent crimes
- Reduce the rate of minor and young adult perpetration of serious property crimes
- Reduce the rate of adolescent and young adult victimization from crimes of violence
- Reduce the rate of all infant deaths (within 1 year)
- Reduce the rate of deaths among adolescents aged 10 to 14 years
- Reduce the rate of deaths among adolescents aged 15 to 19 years

Current Prevention Activities

St. Louis City Department of Health

The St. Louis Health Department of Health's Lead Prevention Program is housed in the Bureau of Family, School, and Community Health. The Lead Prevention Program is staffed with one Public Health Nurse. The PH Nurse is responsible for assuring that all children testing high for blood lead levels receive the appropriate case management, and for coordinating with the St. Louis City Building Division for home testing and abatement.

St. Louis City Lead Inspection and Hazard Control Division

City lead inspectors perform lead inspections to identify lead-based paint hazards. Inspections are performed on residential City properties free of charge where children under six or a pregnant woman resides. Call CSB at 622-4800 or use the form below to request an inspection.

When lead hazards are found, owners may apply for financial assistance. Assistance is awarded based on the following criteria:

- What is the income of occupants?
- Do children under six live at the residence?
- Is the property occupied by the owner?

For more information on qualifying for remediation services, call 641-8255 or 641-8327.

State of Missouri:

The Section for Child Care Regulation (SCCR) is responsible for the inspection, licensure, and regulation of child care programs in Missouri. SCCR staff coordinates annual fire safety inspections conducted by the State Fire Marshal's Office and sanitation inspections carried out by the Division of Community and Public Health (DCPH). SCCR investigates alleged rule and statute violations against regulated child care providers and also approves clock hour training for all regulated child care providers. The SCCR has rules for licensed child care facilities that promote a lead-free environment by requiring an approved sanitation inspection (at initial licensing, annually, and at renewal); lead-free paint to be used for painted surfaces; all indoor furniture and equipment to be free of lead paint; all outdoor equipment to be free of lead paint; and that water be approved by local or state health authorities, or both. The SCCR shares the Questions Regarding Lead Testing Requirements For Children Who Attend Child Care Page 123 of 341 pages Created on 9/22/2017 at 12:02 PM Facilities in High-Risk Areas handout, Evidence of Blood Lead Testing form, and the Refusal of Blood Lead Testing form with new licensing applicants. It links to the Lead Poisoning Internet page on its Resources Internet page located at http://health.mo.gov/safety/childcare/relatedlinks.php in an effort to increase public access to lead poisoning information. Lastly, SCCR shares Consumer Product Safety Commission (CPSC) recall and safety information with regulated child care providers.

The MCH Services Program partners with LPHAs to influence policy and legislation, change organizational practices, foster coalitions and networks, educate providers, promote community education, and strengthen individual knowledge and skills related to the prevention and reduction of intentional and unintentional injuries among children and adolescents. The MCH Services Program staff will serve on local and regional health and safety coalitions and partnerships to promote the prevention and reduction of intentional and unintentional

injuries among children and adolescents. The MCH Services Program will continue to partner with the DHSS Injury Prevention Program, and the MCH Program Manager will serve on the Child Safety CoIIN Cohort 2 team, the Missouri Injury and Violence Prevention Advisory Committee, and the MoDOT Occupant Protection Subcommittee and Coalition for Roadway Safety. The CCHC Program will provide continuing education training, consultation, and technical assistance to child care providers on a variety of injury prevention topics to promote safe child care environments and provide health promotions to children enrolled in day care on a variety of safety topics.

The Missouri Department of Mental Health in partnership with the Department of Health and Senior Services is the recipient of a five-year cooperative agreement from the Substance Abuse and Mental Health Services Administration (SAMHSA) through their Project LAUNCH (Linking Actions for Unmet Needs in Children's Health) program. The goal of this project is to promote child wellness for children from birth to age eight by enhancing and expanding the services and systems serving young children. Missouri Project LAUNCH chose a pilot site of two zip codes in St. Louis City where much of the work is done. Missouri Project LAUNCH capitalizes on St. Louis's existing dedication to young children and rich cultural diversity by concentrating the project's efforts on the north side of the city (ZIP Codes 63106 and 63107). From 10/1/2015 to 09/30/2016 Project LAUNCH participated in the following activities around developmental screening: · Created and disseminated a screening and referral matrix that includes state-wide resources to early childhood service providers including health care professionals, child care providers, home visitors and made it available on the Department of Mental Health, Early Childhood Mental Health website (healthykids.mo.gov); · Developed and rolled out a public awareness campaign around the importance of screening using feedback from the parents in the pilot community as well as the state and local wellness councils;

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